Case studies

Edexcel A Level Geography (Beal High School)

Case studies - geography

1. Palestine + Israel - Water scarcity = drought
2. Aral Sea - restoration
3. Bangladesh – climate change - flooding
4. Kiribati – Is – rising sea level
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6. Australia – GBR – loss of coral reef

Palestine + Israel - Water scarcity = drought

Where is the issue?

Israel was created in 1948, with the conflict between Israel and Palestine starting in 1967. The peace agreement began in 1990 where water sharing and protecting the rights of usage were the main issue. The main area where the situation is of concern is in the West Bank & the Gaza Strip.

What is the issue?

Israel and Palestine share three main water sources. These are the Jordan River basin, the Coastal Aquifer, and the Mountain aquifer, which starts in the heights of the West Bank and flows to the Jordan Valley. Low annual precipitation means most of the water is subterranean. As Israel has limited water resources, 40% of its water comes from Palestine.

Israel uses 2200 Billion litres/year, has only 1700 billion litres. 25% of the water comes from natural sources – the Sea of Galilee, the River Jordan, & the mountain aquifers in the Golan Heights. Israel controls 80% of the mountain aquifers, & 90% of the coastal aquifers. 25% of Israel's water is threatened by Syria.

Which factors are causing this issue?

Over consumption

Israel consumes more water than it has naturally (consumption is 2200 billion litres per year when supply is only 1700 billion litres each year). This has happened due to population growth, which causes over pumping of the aquifers, leading to salt contamination & water pollution. Due to population growth, River Jordan is over used, & the Dead Sea is drying up. By 2050 11 million people living in Israel will need to be supplied with water.

Border disputes & usage restrictions

Israel occupied the West Bank & the Gaza Strip and nationalised the water resources of the occupied territories in 1967. Border disputes cause restrictions in the usage of water. Israel's deliberate destruction of water wells during the wall building in the West Bank causes water shortage for Palestinians.

Israel restricts water use by Palestinians through 3 ways:-

a) Palestinians need permission before water development works (e.g. new water wells), & are prevented from digging for new water wells
b) Palestinians are limited on how much water they can use through water pumps
c) Palestinians pay 3 times the price for water vs those in West Bank (Jewish settlements)

Political conflict and water usage

In 1992 Yasser Arafat (leader of the Palestinian Liberation Organisation) recognised Israel, and Yitzhak Rabin became the PM of Israel. The 1979 Peace treaty & the 1991 Gulf War pushed the Oslo accord, which focused on the rights of water usage. In 1995 Rabin was assassinated, & Benjamin Netanyahu became the PM of Israel. This worsened the political climate, & affected the cooperation on water.

In 2000, the 2nd Intifada (conflict against Israeli occupation of Palestine) eventually led to the rise of Hamas in 2006, which ended all cooperation between the 2 countries. The 2004 plan by Israel to create a desalination plant to flow water to the West Bank was rejected by the Palestinians.

Israel separately developed desalination plants, & by 2009, 20% of domestic water was coming from desalinated water. By 2015, 50% of Israel's water for domestic use, industry & agriculture comes from recycled & desalinated water.

Current situation

Israel has become less dependent on freshwater resources due to breakthroughs in desalination technology. Palestinians continue to suffer water shortages, with the water situation in Gaza & the West Bank still remains a major problem.

In 2015, the Israel/Palestine/Jordan agreement to transfer water from the Red Sea to the Dead Sea was rejected by the Palestinians, as they felt this was more in favour of Israel & Jordan, rather than Palestine.

Possible solutions

1. Develop desalination plants on the Israeli & Palestinian Mediterranean coast could produce much-needed water to both countries, while Northern Jordan could provide solar energy.

2. As desalination is energy-intensive, indirect trade of water against energy could help both countries, e.g. reducing Israeli water withdrawals from Jordan / Mountain aquifer basins in return for electricity from Palestine to Israel.

3. Reduce the production of water-intensive crops such as cotton, tomatoes, lettuce and bananas so that less water is needed in irrigation.

4. Develop drip- fed irrigation systems to the Negev desert areas which uses less water.

5. Recycle sewage water for crops (currently 65% crops grown in Israel use recycled sewage water)

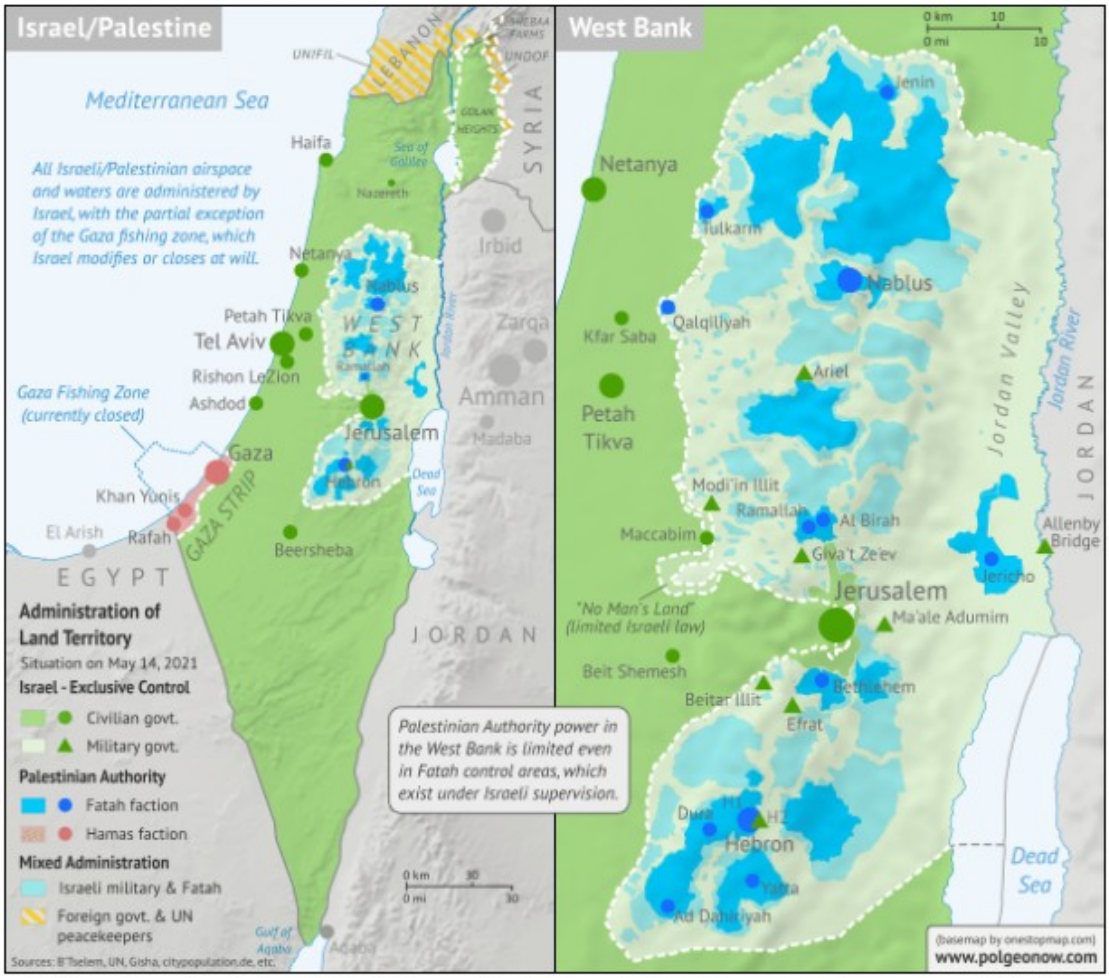
6. Increase food imports, so the countries are less dependent on animal consumption (animal farming needs more water when compared to agricultural farming).

Future projects to resolve the water problem

The Manavgat project is planned to ship 50 Million M^3 of water from Turkey to the region.

Pipe seawater from the Red & Mediterranean Seas to inland desalination plants in Israel.

Increase the import of water rich foods.



Kiribati – Is – the rising sea level

What is the issue?

Global warming is causing glaciers and ice sheets to melt. The average sea level has risen 3.2 mm/year since 1993. This is catastrophic for islands and coastal regions, such as Kiribati, a Pacific atoll nation. Kiribati, whose entire territory is less than 2 metres above sea level (apart from the volcanic island of Banaba), is in danger of submergence. It is predicted that the atoll of Tarawa will be uninhabitable within 50 years.

Where is the issue?

Kiribati is a group of 33 atolls located in the central Pacific between Hawaii and Australia, extending almost as wide as the USA. Half of Kiribati's more than 100,000 inhabitants live in the capital on the main island of South Tarawa (population 50,000, density 6000 people/km^2), a narrow strip of land that lies between the Pacific and an enormous lagoon. Many places in Kiribati are below 1m above sea level. There are no current coastal protections in Kiribati.

The climate context

In the 1989 UN report on the greenhouse effect, Kiribati was mentioned as one of the countries at risk from rising sea levels. In 1999, Abanuea and Tebua Tarawa were submerged under sea. Sea levels in the Kiribati region are rising by 12mm per year (4 times more than global average).

What are the impacts on Kiribati?

Due to the low altitude, storm surges cause the sea to invade the land, contaminating freshwater reserves, killing crops and flooding homes. Shift in weather patterns also push South Tarawa into the hurricane belt. This causes storms to affect the region, destroying homes, crops and livelihood of people. Tourism is also badly affected.

Although Kiribati is only responsible for just 0.6% of world greenhouse gas emissions, it is suffering the most due to rise in sea levels. The former president of Kiribati, Anote Tong purchased 20mh^2 of land in Fiji for agriculture and fish farming projects as Kiribati loses its land to the sea.

What is the current situation?

Many people in Kiribati have already begun to emigrate, leaving for neighbouring islands, or countries such as Australia & New Zealand. Residents have begun building walls out of coral rocks which are then destroyed by the high tide, so are not effective. The ingress of sea water has caused some towns to have shifted a few metres inland, which has caused overcrowding in these towns, leading to poor housing & sanitation. Some areas have mangroves planted to protect the soil from erosion and mitigate storm surges.

Some possible realistic solutions

1. Kiribati government has bought land in Fiji to grow crops and possibly even serve as somewhere to evacuate the country's entire population if the worst does happen.

2. World Bank has argued that Australia and New Zealand should allow open migration of people displaced by climate change from Kiribati and other Pacific islands threatened by the sea.

3. Until now, only the New Zealand government has responded to the needs of the people of Kiribati, allowing 75 people to migrate to New Zealand/year.

4. Allow people to grow and eat local foods, so people from neighbouring islands don't migrate to the island of South Tarawa.

5. The Kiribati government launched a 'mitigation with dignity' policy to allow people to apply for jobs in neighbouring countries, so that people do not have to move as environmental refugees.

6. Restoration of the coral reefs, building of sea walls (storm surge barriers), improving the recycling systems for waste are being planned on the island. Improving the economy through developing tourism, & reducing reliance on the fishing industry are planned.

Bangladesh – climate change - flooding

What is the issue?

Bangladesh ranks 7th on being the most vulnerable to climate devastation, although it only produces 0.56% of the global emissions causing climate change. The average person in Bangladesh emits 0.5 metric tons of CO_2 per year (in USA it is 15 metric tons/person).

In the last 20 years, Bangladesh suffered economic losses worth $3.72 billion and experienced 185 extreme weather events due to climate change. Bangladesh is one of the most vulnerable countries in the world to sea-level rise, increasingly powerful cyclones, & floods.

By 2050, Bangladesh is expected to experience an increase in temperature of about 1.5°C. And between 2040 and 2059, annual rainfall is also expected to increase by 74 mm.

Where is the issue?

Located east of India on the Bay of Bengal, it has many waterways, including the world-famous Ganges River. These waterways produce rich agricultural soil (the delta region). The Sundarbans: the world's largest mangrove forest is a UNESCO World Heritage site provides a livelihood for local people.

90 million Bangladeshis (56% of the population) live in high climate exposure areas, with 53 million people living in very high exposure areas.

The climate context

Sea level rise

Rising sea levels are a growing threat to people all around Bangladesh, because 2/3rd of the country is less than 5 m above sea level, & about a third of the population of Bangladesh lives near the coastal areas.

By 2050, one in every seven people in Bangladesh will be displaced by climate change. With a projected 50 cm rise in sea level, Bangladesh may lose 11% of its land, where 18 million people may have to migrate because of sea-level rise.

The rising seas threaten the Sundarbans which not only sustain biodiversity and livelihoods, but also shields Bangladesh from the worst of the region's many cyclones. It also causes salinization: the process by which salt infiltrates agricultural land damaging crops & contaminating drinking water. Salinity in the country's soil has increased by about 26% over the past 35 years. In the last 40 years, there has been a 1225% increase in land affected by encroaching sea water.

Flooding & urbanisation

Climate change makes rainfall more erratic & intense. In Bangladesh stronger downpours, combined with rising temperatures melting the Himalayan glaciers that feed rivers around Bangladesh, results in devastating floods.

The Ganges-Meghna-Brahmaputra River Basins are destroying entire villages, contributing to over 10 million Bangladeshis already being climate refugees. 12 million children most affected live in and around the powerful river systems which flow through Bangladesh and regularly burst their banks. The most recent major flooding of the Brahmaputra River in 2017 destroyed at least 480 community health clinics and damaged some 50,000 tube wells, essential for meeting communities' safe water needs. 50% of those now living in Bangladesh's urban slums may be there because they were forced to flee their rural homes as a result of riverbank flooding.

Cyclones

The Bay of Bengal narrows towards its northern shore where it meets the south coast of Bangladesh. This funnelling can both direct cyclones towards Bangladesh's coast and make them more intense. As Bangladesh's territory is mostly low, flat terrain, this makes storm surges absolutely devastating.

In the last 10 years, nearly 700,000 Bangladeshis were displaced each year by natural disasters. Stronger cyclones are becoming more common because of our changing climate.

Rising temperatures

Bangladesh has experienced an average rise in temperature of 0.5℃ between 1976 and 2019, with the months from February to November getting warmer. Summers are becoming longer, and winters are getting warmer and the monsoon becoming more unpredictable.

Monsoons

Bangladesh experiences some of the wettest monsoons in the world. The monsoon period is gradually becoming longer, extending now from March to October. Rising temperature during the winter months coupled with erratic rainfall patterns have eroded the distinct seasonality of the monsoon in Bangladesh.

What are the impacts on health?

1. Respiratory illnesses are likely to increase with rising temperature and humidity.
2. Waterborne diseases like cholera are likely to decrease with rising humidity and temperature.
3. Dengue is likely to increase for Dhaka.

Some possible realistic solutions

1. Build 320 solar irrigation pumps benefiting 8,000 farmers
2. Support 17,500-hectare block plantations and 2,000-kilometer strip plantations that are not affected by flooding and saline intrusion
3. Construct 224 new cyclone shelters and repair 387 km of embankment
4. Provide 3.95 million remote households and rural shops with solar home systems, which increased access to electricity
5. Install seven mini-grids to provide continuous electricity to 2,000 rural businesses and shops
6. Distribute clean, energy-efficient cook stoves to 750,000 rural women

Australia – GBR – loss of coral reef

What is the issue?

Temperatures are rising on our land and in our oceans, caused primarily by an increase of carbon dioxide and other greenhouse gases. The current concentration of carbon dioxide in the atmosphere has reached record levels in the last 800,000 years. The Great Barrier Reef is one of the richest and most complex natural ecosystems in the world, but climate change is the biggest threat to its future. The cumulative impacts of recent coral bleaching events and multiple severe tropical cyclones since 2005 have caused an unprecedented decline in the Great Barrier Reef. Any destruction of coral reef leaves the coastline open to coastal flooding and storm surges.

Where is the issue?

The Great Barrier Reef is a complex of coral reefs, shoals, and islets in the Pacific Ocean off the north-eastern coast of Australia that is the longest and largest reef complex in the world. It extends in roughly a northwest-southeast direction for more than 2,000 km, at an offshore distance ranging from 16 to 160 km, and its width ranges from 60 to 250 km, & has an area of 350,000 km^2.

The impact of climate change on the Great Barrier Reef

Coral bleaching

When corals suffer heat stress, they expel the microscopic algae that live inside their tissues, revealing their white skeletons. Bleached corals are not dead, but are more at risk of starvation and disease. There has been a 54% increase in the number of marine heat wave days each year; making it difficult for damaged corals to sufficiently recover. The effect of El Nino every 7 years (increase in water temperatures) contributes to more coral bleaching.

Marine heat waves have triggered three mass coral bleaching events on the Great Barrier Reef in just five years, reducing shallow water coral reefs by as much as 50%. Coral reefs can recover from bleaching over time, but only if temperatures drop and conditions return to normal.

Ocean acidification

The ocean absorbs carbon dioxide from the atmosphere, making it more acidic. This process is known as ocean acidification. Since the late 18th century, the ocean has absorbed about 30% of the carbon humans have generated, decreasing its pH level.

A more acidic ocean means corals are less able to build skeletons and form coral reefs, which help protect coastlines from storms and provide habitats for thousands of species of marine life.

Severe weather events

Climate change is increasing the frequency and intensity of severe weather events. Coastal regions like the Great Barrier Reef are particularly exposed to damaging cyclones, flooding and storms. Between 2004 and 2018, 10 cyclones of category three or more crossed the Great Barrier Reef, causing significant damage to coral reefs.

Habitat changes

As water temperatures rise, many marine species are being forced to move south to cooler habitats. This shift creates increased competition for food and shelter in cooler waters, threatening the entire ecosystem. For Reef communities, the loss of marine life can have a devastating impact on local ecosystems, food sources and other industries such as tourism. Agricultural runoff causes algae to increase, causing deaths of coral.

Geographical threats & impacts of damage to the Great Barrier Reef

Tourism impact

Tourism is the biggest threat globally and locally to coral reefs. The appeal of swimming, snorkelling, diving and sailing in the Reef is dependent on healthy marine life and rich, multi-coloured corals. Climate change threatens not only the Reef but also its $6 billion tourism industry, & the 64,000 jobs that rely on a healthy reef.

Any contact with the human body is likely to kill coral immediately around the point of contact, which is a direct impact of humans diving near corals. The propellers and anchors directly damaging corals from boat tours are a major problem for the GBR, alongside pollution through diesel spills. Removal of coral reef for stone building or tourist sales.

Human Activity

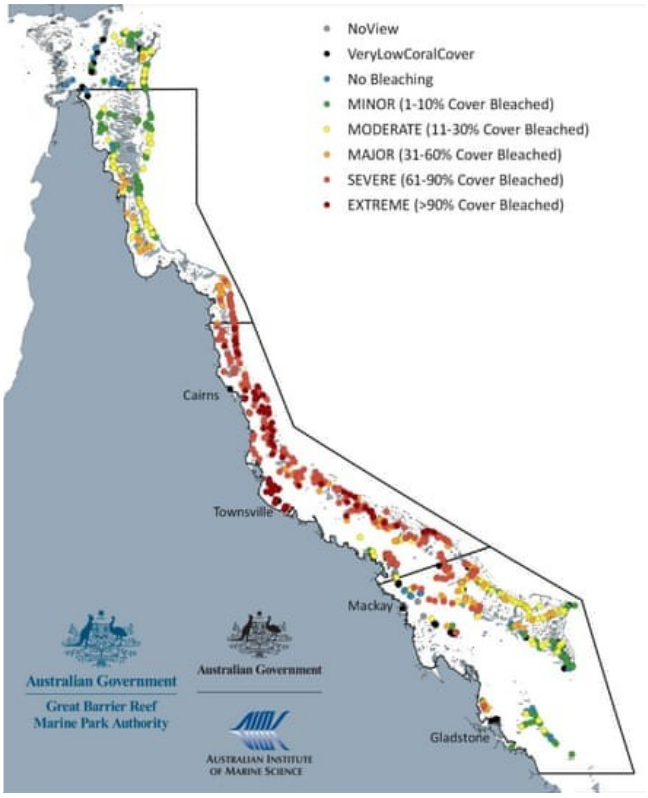
58% of all coral reefs are at threat from human activity. Pollution, overfishing (commercial farming for fish, marine creatures & coral) and quarrying of coral for building stone damages the GBR. Fishing using explosives damages coral reefs. Overfishing reduces the number of grazing fish that keep coral clear of algae. Clearance of coastal forests and mangroves disturbs natural flows of water and nutrients leading to stress and coral bleaching.

Shipping: huge numbers of tourist and commercial traffic which can leave foreign objects and ship wreck, which are damaging to the GBR.

Oil spills: Oil containers can scar reefs and oil spills can damage wild life on reefs.

Overfishing: One of the problems with over-fishing is trawling, causing imbalances in the food web

Trawling: Pulling huge numbers of fish from the sea floor using giant nets, causing imbalances in the food web



Sami – tribe – climate change

What is the issue?

The Arctic is warming twice as fast as the rest of the world. This is putting its unique ecosystem at risk, and with it the existence of Europe's only recognised indigenous people, the Sami, who have lived in the Arctic for millennia. Increasingly unpredictable and extreme weather is jeopardising Sami livelihoods. The sharp decline in reindeer numbers in recent years is threatening Sami herders and the situation is only growing worse as temperatures increase.

Where is the issue?

The Sami, the only recognised indigenous people of Europe, are native to Sápmi, which spans the northernmost parts of Sweden, Norway, Finland and Russia. This region is an important habitat for Arctic and sub-Arctic wildlife; polar bears, moose, seals, walruses, whales and birds have all evolved to survive in the harsh climate of the lowland tundra, mountains and forests.

Sápmi is home to an estimated 80,000-100,000 Sami, with 40,000 in Sweden, 65,000 in Norway, 8,000 in Finland and 2,000 in Russia. They identify as one distinct people irrespective of the national borders now in place across their land. They have existed in harmony with nature as far back as recorded history, through sustainable use of their land and natural resources.

Sami identity and culture are anchored in the traditional practice of reindeer herding. They live semi-nomadically, following the seasonal migration patterns of reindeer as they move between winter and summer grazing grounds. This is the cornerstone of Sami culture and, for many Sami communities, the only way to survive in the Arctic.

The climate context

Arctic warming

The Arctic is warming almost twice as fast as the global average. This is known as 'Arctic amplification' and is projected to strengthen in coming years, mainly due to sea ice melt feedback loops. Sea ice plays an important role in moderating the Earth's temperature because of its high reflectivity. Ice reflects 80% of the solar radiation that reaches it back into space and away from the planet.

As global temperatures rise, sea ice melts and gives way to open ocean, which is 70% less reflective. Arctic sea ice is decreasing rapidly, in both extent and thickness, and it is predicted to continue. Under the worst-case climate change scenario summer sea ice in the Arctic Ocean will likely be virtually non-existent by mid-century.

Marine ecosystem threat

Phytoplankton – micro-algae that form the basis of the food webs for many marine animals – have drastically decreased in abundance as a result of sea ice melt. This threatens a diverse group of wildlife, from shrimp to whales. In addition, many animals, such as seals, walruses, birds and polar bears, rely on sea ice as a place to rest, reproduce or escape predators, In particular, polar bears, which are classified as vulnerable to extinction as they entirely depend on sea ice as a habitat.

Terrestrial ecosystem threat

Melting snow causes the collapse of the spaces between the ground and snow, which are a key habitat for small animals such as lemmings and voles, leaving them without a space to live and forage. Declines in these populations have repercussions which multiply up the food chain, impacting predators such as snowy owls and Arctic foxes.

Increased precipitation

When precipitation falls as rain rather than snow, as it does increasingly as a result of global warming, the result is the formation of a thick layer of ice on the snow, preventing grazing herbivores such as moose or reindeer from reaching the vegetation they need for food.

The Arctic permafrost traps vast quantities of methane; a greenhouse gas with thirty times the global warming impact of CO_2.The melting of Arctic permafrost could result in a sudden and massive release of methane, with potentially catastrophic effects.

What are the impacts on Sami?

Indigenous people tend to feel the effects of climate change first, as their livelihoods often depend on natural resources. As Sami livelihoods, culture and identity are fundamentally linked to reindeer husbandry, it is vital for the Sami that reindeer survive the changing climate.

Unusually high temperatures above freezing are causing more frequent rain, which freezes on the ground into ice. Reindeer, trying to break through this ice layer to access the lichen, expend large amounts of energy, & often they fail entirely to break the ice, and starve to death. In 2013 alone, a total of 61,000 reindeer died as a result of these conditions in Arctic Russia.

In order to survive in the changing climate, Sami herders are purchasing feed pellets to sustain their herds through winter, assisted by the Emergency Fund from the Sami Parliament. However, this supplementary feeding is less than ideal. Not only have reindeer herders observed higher instances of disease among reindeer fed with pellets, but as it is expensive and requires external resources, this practice also makes herding a less economically and environmentally sustainable way of life.

What is the current situation?

The Sami also face encroachments onto their land from mining, energy generation, forestry and tourism. This competition for land use hampers their ability to be flexible and adapt to changing circumstances, such as searching for better summer grazing areas. Cryoconite, a toxic dark heavy metal dust is emitted by industrial operations and once deposited on snow it restricts lichen growth (lichen is the most important fodder for reindeer).

Some possible realistic solutions

1. All countries must raise their emission reduction pledges over time keeping the global temperature level below 1.5℃ above pre-industrial levels.
2. Sweden, Norway, Finland and Russia should collaborate to create a legally binding agreement to allow the Sami flexible migration routes.
3. Oil and gas exploration and drilling in the Arctic must be immediately stopped

Aral Sea - restoration

Location:

The Aral Sea is located in the continent of Asia. It is a Trans boundary lake, with one half in Kazakhstan and the other in Uzbekistan. Rivers enter the Aral Sea, with the Syr Darga entering from the northeast and the Amu Darya entering from the south.

The water supply issue?

In the late 1950s the Soviet government decided that the two rivers that fed the Aral Sea, the Amu Darya from the south and the Syr Darya from the northeast, would be diverted in order to irrigate the desert, in an attempt to grow rice and cotton. The Soviet scheme was based on the construction of a series of dams on the two rivers creating reservoirs, from which 40,000km of canals could be dug to irrigate the fields. Due to this diversion, less and less water reached the Aral Sea causing it to shrink in size.

Economic Impacts:

Due to the diversion of the water from the two rivers, the amount of water in the Aral sea was severely reduced. This has had many economic impacts such as: - The increased salinity of the water meant that fish and other marine life in the Aral Sea died. As a result the Aral Sea fishing industry, which used to employ 40,000 and produced 1/6th of the Soviet Union's entire fish catch, has been ruined. - The reduced flow into the Aral Sea meant that salt was blown onto the surrounding area. Camels therefore died because the grass they were consuming was too salty. One fisherman in the area lost 16 camels as a result of this. - Many factories that lined the coast of the Aral Sea relied on the sea to export and import goods. When the sea dried up this trade route was disrupted and therefore lead to the closure of these factories. This not only reduced the economic output of the area, but also caused the loss of jobs for many local people.

Human health and welfare impacts:

Respiratory illnesses including tuberculosis, cancer, digestive disorders and infectious diseases are common in the region now due to dust containing highly toxic chemicals and fertilisers blowing from the dried sea. - There is a high child mortality rate of 75 in every 1,000 new-borns and maternity death of 12 in every 1,000 women. - Drinking water supplies have is low, with the water being contaminated with pesticides and other agricultural chemicals. The water also contains bacteria and viruses which are causing disease in the Aral region.

Environmental Impacts:

24 species of fish that once thrived in the Aral sea including caviar rich sturgeon, pike, perch and silver carp are now gone due to the high salinity and loss of water. - By the late 1980s, 10,424m2 of the river had become desert and layered with toxic salt. - Water salinity in the 1950s was 10g/litre, however this increased to 26g/litre in 1990 which is far too high for marine life to survive. - Due to a lack of food and freshwater only a few dozen of the 180 land animals survived in the region - The water level has dropped by 16 metres and the volume has been reduced by 75% with the sea having shrunk to 2/5 of its original size and now ranks about 10th in the world.

What is the issue?

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Where is the issue?

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The climate context

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What are the impacts on Kiribati?

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